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09/697,389	10/26/2000	Raoul Florent	PHF 99,595	4651

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EXAMINER	
AKHAVANNIK, HUSSEIN	
ART UNIT	**PAPER NUMBER**
2621	14

DATE MAILED: 05/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/697,389	FLORENT ET AL.	
	Examiner	Art Unit	
	Hussein Akhavannik	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-12 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-12 is/are rejected.

7)☒ Claim(s) 1 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 06 April 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendments to the specification overcome the Examiner's objections cited in paragraph 1 of the previous office action (now Paper no. 10).

Drawings

2. The drawings were received on April 6, 2004. These drawings are accepted.

Response to Arguments

3. Applicant's arguments filed February 9, 2004 have been fully considered but they are not persuasive.

With regard to the 35 USC 112, second paragraph rejection of claims 4-7 and 12, the Examiner acknowledges the correction with respect to the first binary control signal. However, "the" has not been removed with respect to the second binary control signal and therefore, the second binary control signal lacks antecedent basis in claims 1, 2, and 3.

The Applicant alleges that claim 1 of Florent et al is directed towards determining whether a finally filtered pixel value is a temporally filtered pixel value or a spatially filtered pixel value and does not recite inserting spatially filtered data of string points into the temporally filtered data of the background points. The Examiner respectfully disagrees. Claim 1 of Florent et al is directed toward selecting either temporally filtered pixel values as background filtered pixel values or spatially filtered pixel values as threadlike structure filtered pixel values, based on a binary mask, to produce a spatially and temporally filtered second image. Therefore, the second image is created by inserting spatially filtered pixel values between temporally filtered background pixel values in order to create the spatially and temporally filtered second image.

Thus, the spatially and temporally filtered second image of Florent et al would correspond exactly to the filtered second image recited in claim 1 of the present application.

The Applicant alleges that claim 1 of Florent et al is directed towards producing spatially and temporally filtered pixel values of the second original image, whereas claim 1 of the present application recites, performing in each image sequence, temporally filtering the data points located outside the strings' points and spatially filtering the data of the string points. The Examiner respectfully disagrees. Claim 1 of Florent et al recites a "sequence of noisy original images" and explains that the processing is performed on a "first and second successive original image of the sequence". Therefore, the noise reduction processing in claim 1 of Florent et al is not limited to the second original image, but is performed for each successive image (denoted by "a second image") in the sequence of images from the first (and original) image. This processing would result in the noise being reduced for all of the images in the sequence, successive to the first image.

The Applicant alleges that claim 1 of the present application requires that each point of the filtered second image is either spatially filtered or temporally filtered. The Examiner respectfully disagrees. Claim 1 of the present application recites, "temporally filtering the data points located outside the strings denoted background points". This limitation does not exclude the possibility of the temporally filtering the data of the spatially filtered string points as well as the data located outside the strings. Furthermore, "spatially filtering the data of the string points" does not exclude the possibility of spatially filtering the temporally filtered background points as well and the string points. Additionally, the temporal filtering of the present invention is performed on the background points and the string points as illustrated in figure 1. The input of

the temporal filter TPRF (30) is the complete input image Xt or Xt-1 (100), which contain both string points and background points. Therefore, the enhanced image created by spatial filtering and temporal filtering of an image of a noisy image sequence in figure 1 of Aufrichtig et al corresponds to the construction of a filtered second image by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points as recited in claim 1 of the present application.

The Applicant alleges that Aufrichtig et al do not state that only spatial filtering is utilized for data of string points and temporal filtering is utilized for points located outside the strings that are denoted as background points. The Examiner agrees that Aufrichtig et al does not recite such limitations. However, claim 1 of the present application does not require that the spring points only be spatially filtered or that the background points only be temporally filtered, as explained in the paragraph above.

Allowable Subject Matter

4. Claims 5-7 and 12 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claim Objections

5. Claim 1 is objected to because of the following informalities: "denoted background points" should be changed to "denoted as background points". Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 4-7 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to claim 4, "the second binary control" lacks antecedent basis in claims 1, 2, and 3. The Applicant should remove "the" as already done with respect to the first binary control signal.

Referring to claims 5-7 and 12, these claims are indefinite for depending from an indefinite antecedent base claim.

Double Patenting

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

9. Claims 1-4 and 8-11 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 4, 9, and 10 of U.S. Patent No. 6,574,300 (herein Florent et al) in view of Zarge et al (U.S. Patent No. 5,289,373).

Referring to claim 1,

i. Extracting the threadlike structure points corresponds to claim 1 of Florent et al by the "the step of extraction of the threadlike structure". Though Florent et al do not explicitly explain extracting points, Zarge et al illustrate that a threadlike structure of a catheter contains a multitude of points in figure 7. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to extract threadlike structure points in order to create a threadlike structure as the medical images of Florent et al and Zarge et al are digital and thus composed of pixels (or points).

ii. Forming strings from the extracted points corresponds to claim 1 of Florent et al by the "the step of extraction of the threadlike structure". Though Florent et al do not explicitly explain forming strings, Zarge et al illustrate that the structure points are joined to form chains (or strings) in figure 7. A string of points in a digital image corresponds to a threadlike structure as claimed by Florent et al in claim 1. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form strings from the extracted structure points in order to create a threadlike structure as the medical images of Florent et al and Zarge et al are digital and thus composed of pixels (or points).

iii. Temporally filtering the data of the points located outside the strings denoted background points corresponds to claim 1 of Florent et al by the "temporally filtered pixel values of the second original image" and further by the "temporally filtered pixel value as a background pixel value". The temporal filtering of the present invention is performed on the background points and the string points as illustrated in figure 1. The input of the temporal filter TPRF (30) is the complete input image Xt or Xt-1 (100),

which contains both string points and background points. Therefore, by temporally filtering the pixel values of the second original image (corresponding to Xt), Florent et al are temporally filtering the data of the points located outside the strings.

iv. Spatially filtering the data of the string points corresponds to claim 1 of Florent et al by the "spatially filtered pixel value as a threadlike-structure filtered pixel value". Thus, the spatially filtered points of Florent et al are the string points.

v. Constructing the filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points corresponds to claim 1 of Florent et al by the "step of pixel value selection based on said binary mask image pixel values for producing respectively, as a finally filtered pixel value". The final pixel value that constitutes part of the filter second image is selected from either a temporally filtered pixel value representing a background pixel or a spatially filtered pixel representing a threadlike-structure pixel. Therefore, by selecting the both spatially and temporally filtered pixels, the spatially filtered pixels are inserted into the temporally filtered pixels.

Referring to claim 2, providing a binary control signal formed of a list of the string points with their running number on the strings and their co-ordinates in the processed image, which determines whether the current point is a string point or a non-string point regarded as a background point corresponds to claim 3 of Florent et al. Florent et al select the pixel value (temporally filtered which corresponds to a background pixel or spatially filtered which corresponds to a thread-like structure pixel corresponding to claim 1iii and 1iv above) according to a binary control signal value at the current pixel location, which is inherently determined by

the pixel co-ordinate. A running number on the strings is not explicitly explained by Florent et al, however, Zarge et al illustrate the running number of thread-like structures defined by strings of pixels in figure 7. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the running number of the string points in the binary control signal of Florent et al in order to connect the pixels of a string in the correct sequence, thereby assuring an accurate thread-like structure.

Referring to claim 3, supplying the binary control signal for controlling the insertion of the spatially filtered data of the string points into the temporally filtered data of the background points corresponds to claim 3 of Florent et al. Insertion of the spatially filtered data into the temporally filtered data corresponds to claim 1v above. Florent et al further explain in claim 3 that the pixel value selection is determined according to the binary control signal.

Referring to claim 4, delivering the binary control signal for controlling the insertion operation through a logic OR operation, whose inputs are the first and the second control binary signals related to the first and the second sequence images, the OR operation triggering the spatially filtered data when at least one of the two binary control signals corresponds to a string point corresponds to claim 4 of Florent et al. Florent et al explain using a logic OR operation to select the pixel value according to the control binary signals of the first and second binary mask image.

Referring to claim 8, the images being medical examination digital images and the thread-like structure being a catheter guide wire is not explicitly explained by Florent et al. However, Zarge et al do explain the images being medical images and the thread-like structure being a catheter guide wire in the abstract. It would have been obvious to one of ordinary skill in

the art at the time the invention was made to determine the threadlike structure of a catheter guide wire in order to accurately display the guide to a physician for real-time tracking.

Referring to claim 9, this claim corresponds to claim 10 of Florent et al wherein all the limitations of this claim are represented by claim 1.

Referring to claim 10, the X-ray apparatus having access to the medical image data for processing the medical image data corresponds to claim 10 of Florent et al wherein the apparatus acquires "a pixel value at a current pixel location in a first and a second successive original image of the sequence".

Referring to claim 11, this claim corresponds to claim 9 of Florent et al wherein all the limitations of this claim are represented by claim 1 above.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-3 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aufrichtig et al (Aufrichtig, R., Wilson, D.L.; X-ray Fluoroscopy Spatio-Temporal Filtering with Object Detection, Medical Imaging, IEEE Transactions on, Volume: 14 Issue: 4, Dec. 1995, Page(s): 733 –746) in view of Zarge et al.

Referring to claim 1, which is representative of claims 9 and 11,

i. Extracting the threadlike structure points is explained by Aufrichtig et al on page 734, second column, sixth paragraph to page 736, first column, second paragraph and

illustrated in figure 2 by the matched filter. The match filtering detects and roughly segments the line-like structures, which represent the catheter guide, wire as explained by Aufrichtig et al on page 734, second column, second paragraph. The result of the matched filter is a likelihood image containing line-like structures.

ii. Forming strings from the extracted points is not explicitly explained by Aufrichtig et al. Though Aufrichtig et al do explain that the extracted points will exhibit line-like structures on page 734, second column, fifth paragraph, they do not explicitly explain forming strings from the extracted points. However, Zarge et al illustrate that the structure points are joined to form chains (or strings) in figure 7. A string of points in a digital image corresponds to a threadlike structure as explained by Aufrichtig et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form strings from the extracted structure points in order to create a threadlike structure as the medical images of Aufrichtig et al and Zarge et al are digital and thus composed of pixels (or points).

iii. Temporally filtering the data of the points located outside the strings denoted background points is explained by Aufrichtig et al on page 736, second column, first paragraph to page 737, first column, third paragraph. The temporal filtering of Aufrichtig et al is applied to an entire input medical image. However, the temporal filtering of the present invention is performed on the background points and the string points as illustrated in figure 1. The input of the temporal filter TPRF (30) is the complete input image Xt or Xt-1 (100), which contains both string points and background points.

Therefore, by temporally filtering all the pixel values of an input medical image, Aufrichtig et al are temporally filtering the data of the points located outside the strings.

iv. Spatially filtering the data of the string points is explained by Aufrichtig et al on page 736, first column, third to fifth paragraphs. Aufrichtig et al explain that the filtering is performed on the pixels of the object-likelihood image and therefore, the string points.

v. Constructing the filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points is illustrated by Aufrichtig et al in figure 1. The spatially filtered pixels and the temporally filtered pixels are combined to form the enhanced image sequence.

Referring to claim 2, providing a binary control signal formed of a list of the string points with their running number on the strings and their co-ordinates in the processed image, which determines whether the current point is a string point or a non-string point regarded as a background point is not explicitly explained by Aufrichtig et al. Though Aufrichtig et al do provide an object-likelihood image, which acts as a binary signal by identifying the probably object pixels (wherein each pixel is inherently associated with a co-ordinate), Aufrichtig et al do not explicitly explain providing the running number of the string points and their co-ordinates. However, Zarge et al illustrate the running number of thread-like structures defined by strings of pixels in figure 7. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the running number of the string points in the object-likelihood image of Aufrichtig et al in order to connect the pixels of a string in the correct sequence, thereby assuring an accurate thread-like structure.

Referring to claim 3, supplying the binary control signal for controlling the insertion of the spatially filtered data of the string points into the temporally filtered data of the background points corresponds is illustrated by Aufrichtig et al in figure 1. Aufrichtig et al illustrate that the object likelihood image (corresponding to the binary control signal) is used to create the enhanced image sequence and therefore, the binary control signal is supplied to control the insertion of the spatially filtered data into the temporally filtered data.

Referring to claim 8, the images being medical examination digital images and the thread-like structure being a catheter guide wire is explained by Aufrichtig et al in the abstract.

Referring to claim 10, the X-ray apparatus having access to the medical image data for processing the medical image data is illustrated by Aufrichtig et al in figure 1 by the noisy image sequence being input into the system.

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hussein Akhavannik whose telephone number is (703)306-4049. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on (703)305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hussein Akhavannik H.A.
April 29, 2004

BRIAN WERNER
PRIMARY EXAMINER